THE TELEGRAPHIC JOURNAL.

VOL. III.—No. 59.

ARBITRATION.

THERE is no question that interests English telegraphists more than the rise and progress of the Post Office Telegraph system. It is the largest self-governed system in the world. It has over 106,000 miles of wire, and over 5,000 stations open to the public. Its revenue is £1,300,000. It is in intimate alliance with all the railway companies on the one hand, and, by means of its cables, with all the continental nations on the other. Though financially it has not yet proved a success, in every other sense the British public are well satisfied with their bargain, and with the efforts that have been made to make postal telegraphy cheap, rapid, and accurate.

When the transference of the telegraphs to the State was determined upon, it was found that there were not only several telegraph companies to be purchased, but many railway companies, who not only carried on telegraphic trade on their own account, but who possessed beneficial interests in the poles and wires erected by the telegraph companies on their lines. The terms of purchase and compensation were arranged by negotiation with all the telegraph companies and with several railway companies, but the remainder of the railway companies, either from want of time or of inclination on their part, were left to be dealt with by arbitration. The 9th Section of the Telegraph Act of 1868 fully detailed the conditions under which these railway companies were to be compensated for the loss of their privileges. The railway companies to be settled were scheduled. They were the London and North Western, the Midland, the Lancashire and Yorkshire, the Great Northern, the Manchester, Sheffield and Lincolnshire, the North Staffordshire, the Great Eastern, the London, Brighton, and South Coast, the Metropolitan lines, and some Scotch railways. The Scotch railways, the Brighton, and the North Western have been settled by agreement. The others have chosen to go to arbitration.

The Great Eastern is the only case that has been heard and settled. The Lancashire and Yorkshire claim has been heard, and is now under consideration. The claims that have been submitted have been fabulous in their amount, and the anticipations of the companies have been so extravagant that unpleasant rumours have for some time been current as to the additional capital sums that would be required to satisfy these claimants. The Great Eastern award has, fortunately, dissipated these rumours. The umpire was the Recorder of London, Mr. Russell Gurney, and the case has been under consideration for many months. The railway company claimed a capital sum of £412,000, with interest at 5 per cent. from the 30th of June, 1874, and an annual payment for way-leave representing, if capitalized, altogether over £500,000. Of this exorbitant demand, they have received £73,315, and an annual payment of £200 a-year. The costs of the company in preparing their claim were over £12,000, and this sum has been taxed down to £3,000.

It has been frequently asserted that the telegraph companies were possessed of nothing more than a lease for a term of years of the telegraph wires, and that it was only after the negotiation between the Government and the telegraph companies that it was discovered that the fee simple reverted eventually to the railway companies, and that it was found necessary to purchase their reversionary interests. Nothing can be more inaccurate. The position of the railway companies was thoroughly and completely explained to the Select Committee of the House of Commons. The Act was passed to deal with all these cases, and it has been found sufficient to meet every case hitherto considered under it. Mr. Scudamore estimated the amount likely to be received by the railways, and there is every indication that his estimate will not be reached.

It is difficult to divine the reasons that can have induced the railway companies to put forward such outrageous claims. Their facts or their mode of calculation must have been very erroneous. Doubtless the enormous strides made by postal telegraphy, and the great increase shown weekly in the columns of the press in the number of messages sent have raised these golconda-like visions. But surely they must have miscounted the growth due to the extension of the system into unprofitable districts, and they cannot have taken the increase in the number of messages due to reduced tariffs as an indication of the growth of profits. Telegraphy under the Post Office management has grown enormously, but while the cost of telegraphing to the public has materially diminished, the cost of working has also increased, and the result is that though the business has grown the profits have contracted.

The ultimate financial success of the undertaking can only be a question of time. The rate of working expenses to gross revenue must gradually decrease, and even now the latter far exceeds the former. As one of our contemporaries observes, the Great Eastern award has an important bearing

upon the financial success of the working of the telegraphs by the State, and it is hoped that it will lead to a speedy settlement with the railway companies that remain to be dealt with.

RESISTANCES AND THEIR MEASUREMENT.

By H. R. KEMPE.

(Continued from page 152.)

XVIII.

THE formulæ obtained in our last article are capable of various modifications, which, however, are more of a fanciful than of an actual practical value.

Thus the formulæ—

$$R = \frac{T}{C \log_e \frac{V}{v}} \quad \text{and} \quad C = \frac{T}{R \log_e \frac{V}{v}}$$

may be simplified if we make $v = \frac{V}{2}$ in which case—

$$\log_e \frac{V}{v} = \log_e 2 = \cdot 693$$

therefore—

$$R = \frac{T}{\cdot 693\, C} = 1 \cdot 433 \frac{T}{C}$$

$$\text{and } C = 1 \cdot 443 \frac{T}{R}$$

This latter formula is found to give the same result as the direct method of measurement, after one minute's electrification, provided the battery be put to the cable for 10 seconds before taking the discharge, and again 10 seconds before insulating it preparatory to taking the discharge reading after the interval of time T.

To obtain the time occupied in falling to half charge experimentally, repeated trials would be necessary, and the time taken in doing this would hardly compensate for the advantage of using a simpler formula.

The object of obtaining the time of fall to half charge is to get a convenient unit for comparison with other cables, and this time of fall is easily calculated from the formula before given, in which the potential after any time may be used, and this is obtained by one observation only.

Another modification of the fall to half potential formula is that of Mr. Preece, viz.—

$$V t_2 = \frac{\cdot 30103}{2 \cdot 000 \log_e (100\, n)} t_1$$

where n = percentage of loss in interval of time t_1.

From the equations in article XVII—

$$V \left(\frac{v}{V} \right)^{t_1} = v_1$$

$$V \left(\frac{v}{V} \right)^{t_2} = v_2$$

we can find what would be the potential, v_2, after a certain interval of time, t_2 having given the potential at first, and the potential v_1, after a time, t_1.

We have from these two equations—

$$\left(\frac{v_1}{V} \right)^{t_2} = \left(\frac{v_2}{V} \right)^{t_1}$$

therefore—

$$v_2 = V \left(\frac{v}{V} \right)^{\frac{t_2}{t_1}}$$

This formula we should have to work out by the aid of logarithmic tables.

And so the formulæ might be expanded and modified to almost any extent to suit various cases, but upon which it is unnecessary to dwell here.

(To be continued.)

ERRATA.

Owing to an accident the proof sheet of the last article was not revised. The following corrections will therefore be necessary.

1st column—

For "vebu" read "veber."

2nd paragraph—For "during 7 secs." read "during 1 sec."

4th paragraph—For "potential driving A out" read "potential driving it out."

2nd column—

For—

$$\frac{T}{n\, C\, R} = -\frac{1}{X}$$

read—

$$\frac{T}{n\, C\, R} = -\frac{1}{x}$$

For—

$$q = Q \left[\left(1 \times \frac{1}{x} \right)^{x} \right] - \frac{T}{C\, R}$$

read—

$$q = Q \left[\left(1 + \frac{1}{x} \right)^{x} \right]^{-\frac{T}{C\, R}}$$

For—

"Expression within square brackets is known to be equal to z."

read—

"Expression within square brackets is known to be equal to e."

for—

$$\frac{q}{Q} = z - \frac{T}{C\, R}$$

read—

$$\frac{q}{Q} = e^{-\frac{T}{C\, R}}$$

for—

$$\frac{T}{C\, R} = \text{by } {}_z \frac{Q}{q}$$

read—

$$\frac{T}{C\, R} = \log_e \frac{Q}{q}$$

For—

$$R = \frac{T}{C \text{ by } {}_z \frac{Q}{q}}$$

read—

$$R = \frac{T}{C \log_e \frac{Q}{q}}$$

For—

$$R = \frac{T}{C \text{ by } {}_{2}\frac{V}{v}}$$

read—

$$R = \frac{T}{C \log._{e} \frac{V}{v}}$$

Two lines below this, for "t is measured in seconds, c in farads, and r in ohms," read "T is measured in seconds, C in farads, and R in ohms;" for "mirrofarads" read "microfarads."

3rd column—

For "The A Cable," read, "A Cable." For "5 per cent. of its charge during the 1st second," read, "5 per cent. of its charge is lost during the 1st second."

For—

"$\frac{1}{N}$ th" read, "$\frac{1}{n}$ th"

For "potential left at end of first 2nd," read, "potential left at end of 1st second." For "potential left at end of second second will be—

$$v - \frac{v}{n} = v \text{''}$$

read, "potential left at end of 2nd section will be—

$$v - \frac{v}{n} \text{''} \qquad (1)$$

for—

$$n = \frac{V}{V - v}$$

read—

$$n = \frac{V}{V - v}$$

for "therefore substituting j we get—

$$\frac{v_2}{V} = V\left(\frac{v}{V}\right)^2$$

read" therefore substituting this value in (1) it becomes

$$\frac{v_2}{V} \text{ which equals } V\left(\frac{v}{V}\right)^2$$

4th column—

for—

$$t_2 = \frac{\cdot 30103}{\log. \frac{V}{v_1}}$$

read—

$$t_2 = \frac{\cdot 30103}{\log. \frac{V}{v_1}} \cdot t_1$$

For—

$$c = \frac{t}{R \log. \frac{V}{zv}}$$

read—

$$C = \frac{T}{R \log._{e} \frac{V}{v}}$$

ON TELEGRAPH CONSTRUCTION.

By JOHN GAVEY, Assoc. Soc. T. E.

(Continued from page 148.)

In surveying for a line along a railway, fewer difficulties are met with than on a high road. The surveyor has, as a rule, considerable latitude as to the ground he will occupy; he has no obstinate and fretful opposition from neighbouring landowners to contend with, and practically he finds himself at perfect liberty to follow whatever plan he may think most desirable. A few definite rules, however, may be laid down as of more or less general application.

The spans adopted may generally be longer than on high roads, or, in other words, fewer poles per mile are needed. The reasons are obvious, inasmuch as the curves are always more regular and gentle; and, moreover, on railways, as a rule, every pole can be stayed, so as to give the whole line a degree of stability and freedom from swaying, which on high roads is obtained by an increase in the amount of timber used. This diminution in the number of poles, which may vary from 16 to 22 or 24 per mile, does not necessarily involve a diminution in the cost of the stores, for in some cases the value of the additional stays, rods, and ratchets equals that of the timber saved. The poles on a railway should, where practicable, be placed at such a distance from the lines of metals, that in the event of their being blown down they would fall clear of passing trains. Space should also be given for staying both sides. They should, however, be always when possible, so placed that a clear view of the wires may be obtained from a railway carriage. This is of great importance in the tracing and speedy removal of faults.

In following banks and cuttings, it is preferable, whilst bearing the foregoing remarks in mind, to place the poles in such a manner that they may be as sheltered as possible from heavy winds. In precipitous cuttings however, it is occasionally advantageous to go over the top, to avoid interruptions from falling rock, &c. This is especially the case in such cuttings as have their sides almost vertical. In putting up a main line, it is generally found necessary to carry the wires over all bridges, as with the number of wires now running along each trunk line of railway, there is not room to go through any, except the most lofty ones, without danger of numerous contacts and interruptions from accidental causes. When building light lines, however, the wires may with advantage be taken through most ordinary bridges. In crossing a bridge which carries a public thoroughfare, it is the usual practice to erect two poles, one on each side of the bridge. The object is to minimise the danger of a broken wire at any time obstructing the highway.

Tunnels are an occasional source of difficulty. When wires can be carried over them it is generally done, but inasmuch as such portions are necessarily out of sight of officials travelling by train, great care should be taken to lay out and construct such lengths in the most secure and substantial manner. It however frequently becomes necessary to go through them. If the tunnels are dry and the wires not too numerous, they may be carried

hrough open on bridge brackets; but with wet unnels, or numerous wires, it is better to lay covered work. The various methods of doing this will be described in dealing with underground and covered work.

Station buildings and goods yards frequently cause some difficulties in getting through, but these are generally overcome by the use of lofty timber, and by varying the spans.

It is frequently the practice to terminate all wires in crossing over lines of rails, and whether this be done or not, it is an advantage to stay the poles on either side longitudinally or in the direction of the wires themselves. If any poles are blown down, or demolished by trucks getting off the road, the wires are thus kept from dropping across the metals, and the damage is limited in extent.

The average length of the poles used on the railways is, for heavy lines, about 28 to 30 feet, as on roads. At crossings, bridges, stations, and other localities, where necessary, the length is of course increased, the same general rules being followed as have already been dwelt upon. It is generally the practice to erect square timber on station platforms, both to provide for leading in the wire, and to harmonise with the general construction of the surrounding buildings.

In laying out the route of the poles the offsets are usefully taken from the rails when it is practicable. This saves much trouble in obtaining measurements, for, as the rails follow a more or less uniform course, the distances need not be measured at each pole, as in a road survey, but only at points where it becomes necessary to vary the offset. Surveys on railways are thus made with much greater speed and with much more ease than on roads. On viaducts the poles are generally bolted to the parapets, when these are sufficiently strong to bear the strain of the wires. For important work square timber is generally with advantage used in such cases. If properly selected and cut to the right dimensions, it resists the strain and stands better than round timber. It is also more durable, and is more easily fitted to the walls and abutments. Where but three or four wires have to be erected the expense of poles may be avoided by the use of bridge or wall brackets.

In canals and open country work, in addition to such of the points already mentioned which will be found applicable, care must be taken in crossing canals and navigable streams, either to carry the wires at such a height as will avoid interruptions from the masts and yards of sailing vessels and barges, or to carry them through by means of cables. Moreover, such localities and directions should be chosen as will admit of any of the poles being readily reached, either for inspection or for the removal of faults. A thick impenetrable underwood growth should be avoided, and when woods have to be traversed an open route practicable for horsemen should be selected. Lands liable to be flooded for considerable periods, should be avoided, and the principal consideration to be borne in mind in planning the line, should be to avoid any obstruction or impediment likely to interfere with the facile maintenance of the whole work after its completion.

ROYAL INSTITUTION OF GREAT BRITAIN.

NOTES OF PROFESSOR TYNDALL'S LECTURES ON ELECTRICITY.

FEBRUARY—MARCH, 1875.

(Concluded from page 137.)

NOTES OF LECTURE VII.

1. LORD MAHON in 1789 first observed and thoroughly investigated the "return shock." Within twenty inches of the prime conductor of his machine, he placed a second insulated conductor, and within one-tenth of an inch of the latter, a third conductor. When the machine was worked a thin stream of purple sparks passed over this small interval. On stopping the machine and discharging the prime conductor, a single brilliant spark filled the space between the second and third conductors.

2. The principles already established furnish the explanation here. By the prime conductor (charged positively) the second conductor was acted on inductively. Its negative electricity was attracted and its positive repelled. This repelled electricity produced the thin stream of purple sparks first observed. The second conductor is, therefore, to be figured as deprived in part of its positive electricity, its negative being held captive by the prime conductor. On discharging the latter, the natural condition was restored, the repelled electricity returning from the third conductor to the second in a single brilliant spark.

3. Lord Mahon fused metals, and produced strong physiological effects by the return shock.

4. In nature disastrous effects may be produced by the return shock. The earth's surface, and animals or men upon it, may be powerfully influenced by one end of an electrified cloud. Discharge may occur at the other end, possibly miles away. The restoration of the electric equilibrium by the return shock may be so violent as to cause death.

5. It was the action of the return shock upon a dead frog's limbs, observed it is said by his wife, in the laboratory of Professor Galvani, that led to Galvani's experiments on animal electricity; and led further to the discovery, by Volta, of the electricity which bears his name.

Analysis of Holtz's Electrical Machine.

6. It has been already shown in these lectures that an insulated conductor with a point attached to it may be charged, by simply presenting the point to an electrified body. This we know to be due to the streaming of the opposite electricity from the point against the electrified body.

7. If between the electrified body (charged say negatively) and the point, a plate of glass be introduced, induction will take place as before; but the positive electricity discharged from the point will cover the surface of the glass, instead of diffusing itself over the electrified body. The conductor, in this case, will be charged negatively.

8. If the glass surface thus positively electrified be removed and presented to a second point, attached to a second insulated conductor, the negative electricity will stream from the point to

neutralize the positive upon the glass. In this case the conductor, by the loss of its negative electricity through the point, will be charged positively.

9. The performance of Holtz's electrical machine is, in part, due to the action here described. The negatively electrified body is a piece of paper supported by an insulator (a stationary glass disk is employed for this purpose by Holtz). Opposite to the excited paper is placed, not a single point, but a metallic comb of points, connected with a conductor. Between the electrified paper and this comb is a glass disk capable of rapid rotation. When the paper is excited, the opposite, or positive, electricity is drawn from the comb against the glass, the conductor associated with the comb being thus charged negatively. The positive electricity is carried on by the glass and presented to a second comb placed diametrically opposite to the first. From this second comb negative electricity streams to neutralize the positive electricity of the glass, the conductor associated with the comb being charged positively. In this way two insulated conductors, connected with the two combs, can be oppositely electrified, and when the action is sufficiently strong, discharge, in the form of sparks, will pass between the conductors.

10. But this by no means fully explains the action of Holtz's machine, and to understand the explanation considerable attention will be necessary. We will approach the subject gradually.

11. First, then, we know that natural insulators are attracted by electrified bodies. An unrubbed glass rod is attracted by a rubbed one; unrubbed sealing-wax is attracted by rubbed sealing-wax. This can only occur through induction, as already explained.

12. Again, we know that when the ordinary electrophorus is excited by friction, negative electricity covers its resinous surface.

13. What we have now to add to our knowledge is this, that the layer of negative electricity with which the electrophorus is charged acts inductively upon the electrophorus itself, driving the negative of the resin to its opposite surface, and producing a positive layer between the induced and the inducing negative. The existence of the negative electricity on both sides of the resinous cake, after one side only has been excited, may be proved by the electroscope.

14. But it is only necessary to permit the cake to rest for some minutes on a metal surface connected with the earth, or for a somewhat longer time upon a common table, to abolish the negative electricity. If the cake be then turned upside down, the positive electricity of its under surface may be shown by the electroscope.

15. A disk of vulcanized india-rubber is specially suited for the rapid execution of this experiment. Whisked on one side with a fox's brush, both sides are negative. Laid with its unwhisked surface upon a table, the electricity of that surface is immediately discharged, and, on reversal, the lower surface proves to be the positive.

16. What is true of the resin cake and the india-rubber, is true of insulators generally. If one surface, for example, of a dry glass plate be electrified, it will act by induction on the rest of the plate, covering its opposite face with electricity like its own, and producing nearer to itself a layer of opposite electricity.

17. In such a plate, therefore, we have three layers of electricity, one of them communicated, and the two others inducted.

We are now, I think, prepared for the explanation of Holtz's machine.

18. Its simplest form consists of a rotating glass disk, and a fixed glass disk, on which, at the opposite ends of the same diameter, two patches of paper, provided with cardboard points, are glued. The fixed glass disk does not belong to the active part of a machine at all; it is merely employed to support the patches of paper, and to keep them insulated from each other. Out of the fixed glass disk are cut two small sectors, in which the points of cardboard freely hang.

19. Opposed to each patch of paper is placed a metal comb, the rotating disk moving between the comb and the patch of paper. Each comb is connected with an insulated brass rod bearing a knob; the two knobs being capable of being placed in contact with each other, or drawn asunder.

20. The first step towards setting the machine in action is to bring the two knobs just referred to together, and into connection with the earth. Any stray electricity lingering about the combs and knobs, which might interfere with the action of the machine, is thus got rid of.

21. Let the glass disk be set in rotation, and let an excited plate of gutta percha be brought near one of the patches of paper. It acts while there, not only on the paper, but on the metal comb immediately opposite. From that comb, against the rotating disk, is poured positive electricity, the brass rod and knob, associated with the comb, being left negatively electrified.

22. The electricity thus diffused by the comb over the surface of the glass is carried forward by the rotating disk; but here we have to remember the principle just laid down, namely, that by the inductive action of the electricity thus covering the disk, two other layers are evoked, one covering the opposite face of the disk and an opposite one within it.

23. That both surfaces of the rotating disk are here charged positively, can be proved by the electroscope. It is not a matter of theory only, but a matter of fact.

24. Let us, for the sake of distinction, call the surface of the disk turned towards the patches of paper, the inner surface, and the surface turned towards the combs, the outer surface of the rotating disk.

25. Imagine then the moving disk with both its surfaces covered, in the manner described, with positive electricity. The inner surface thus charged comes first into the neighbourhood of the cardboard point of the second patch of paper. From that point negative electricity is poured against the inner surface, neutralizing the positive of that surface. The second patch of paper is thus electrified positively, by the action of the machine itself.

26. This is a very important point to bear in mind; for, were the charge upon the patches of paper not continually renewed, the electricity would rapidly waste itself, and all action would cease.

27. But let us follow the positive electricity of the outer surface a little farther. After passing the cardboard point on the one side, it comes opposite to the metal comb on the other. Here it is

neutralized by the discharge of negative electricity from the comb; the brass rod and knob associated with the comb are thus electrified positively.

It is to be borne in mind that the body charged by a point is always furnished with the opposite electricity to that which streams from the point.

28. Let us now halt and sum up. We started from our first comb with three layers of electricity, one communicated by the comb, and the two others induced by this one. By the second cardboard point the positive induced layer was neutralized, the patch of paper associated with the cardboard point becoming, through the loss of its negative, positively electrified. A moment afterwards the positive electricity of the hinder surface was neutralized by the second comb, which poured against that surface negative electricity.

29. But over and above the quantity necessary for mere neutralization, the second metal comb, acted on inductively by the second patch of paper (now positive), poured out a still further amount of negative electricity against the surface of the disk. This also acted inductively upon the disk itself, as the positive layer did in the first instance. We have, as before, three layers of electricity; one (negative) communicated; two (positive and negative) induced; and besides these we have the negative electricity remaining over from the first act of electrification, and which was not neutralized by either the second cardboard point or the second metal comb. It is obvious from this analysis that one-half of the rotating disk must be furnished on both sides, with positive, and the other half with negative electricity.

30. The glass surface, thus negatively charged, passes on to the cardboard point of the first patch of paper (the point on both patches being turned to face the motion). Positive electricity streams from the point against the inner negative surface of the disk, the patch of paper being thus charged negatively. Immediately afterwards the negative electricity of the outer surface is neutralized by the comb, which, over and above this, is acted on by the negatively excited paper. In virtue of this action it charges the disk anew with positive electricity, which, with its two induced layers, passes on as before.

31. Thus the patches of paper, to whose inductive action the generation of the electricity is due, are continually charged by a portion of the electricity brought into play. The diffusion of the electricity in the air is thus made good, and in favourable weather the action may be prolonged indefinitely.

32. When the knobs associated with the two metal combs are drawn apart, the discharge passes between them in a stream of sparks. Connecting with the conductors (the brass rods and knobs aforesaid) a small Leyden jar, the jar is rapidly charged and discharged, the sparks being thus rendered long, loud, and brilliant.

33. The play of the electricity in Holtz's machine is perfectly obvious in the dark. The positive comb declares itself by beautiful streams of blue light darting from its points; while every point of the negative comb is tipped by a little star. The former is technically termed the "brush," and the latter the "glow."

34. Omitting all superfluous details and complications, but retaining every essential point, I have here sought to present in a compact, and easily comprehensible form, the theory of Holtz's machine developed by Riess in a series of papers extending from 1867 to 1874. An experimental examination of the machine, when in action, shows that the condition of all its parts corresponds with the theory here given.

REMARK:—Two rotating and two fixed disks may be employed, instead of one. The explanation is the same. A small machine, with a single rotating disk, left to us by Dr. Bence Jones, and a larger machine, the property of Mr. Wm. Spottiswoode, were shown in action in the lecture. The former yielded sparks four inches long, the latter sparks full seven inches long.

35. The course concludes by connecting the electricity of friction and induction with other sources and forms of this power.

The contact of dissimilar metals produces electricity.

The contact of metals with liquids produces electricity (Volta).

A mere variation of the character of the contact of two bodies produces electricity (Zamboni, Behrens, and De Luc).

Chemical action produces a continuous flow of electricity (Voltaic electricity).

Heat, suitably applied to dissimilar metals, produces a continuous flow of electricity (thermo-electricity).

The heating and cooling of certain crystals produce electricity (pyro-electricity).

The motion of magnets, and of bodies carrying electric currents, produces electricity (magneto-electricity).

The friction of sand against a metal plate produces electricity.

The friction of condensed water-particles against a safety-valve, or, better still, against a box-wood nozzle through which steam is driven, produces electricity (Armstrong's hydro-electric machine).

These are different manifestations of one and the same power; and they are all evoked by an equivalent expenditure of some other power.

ON A SYSTEM OF QUADRUPLEX TELEGRAPHY.

By H. R. KEMPE.

THE quadruplex system of telegraphy, by which is meant a system of sending two messages along a single wire in one direction simultaneously with two others being sent in the other direction, has been a favourite problem with telegraphists, but has hitherto had but little success, although we understand that in America a system of this kind is in use, which works well.

The primary question to be solved is that of sending two messages along the same wire in the same direction at the same time.

Such a problem, it is stated, has been solved by Stark, of Vienna; but a little consideration of his system would show that it would not answer in practice.

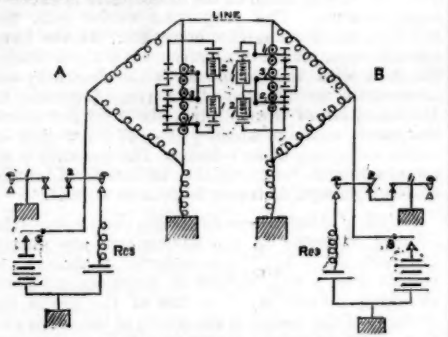
It consists of sending from the transmitting station, by two keys, currents of different intensities, the arrangement being such that on pressing one key a current of an intensity 1 is sent; on

pressing the second key, a current of an intensity 2; and on pressing both keys together, both currents are sent on the line, giving an intensity 3. The current 1 acts upon a relay sensitively adjusted, which works a recording instrument corresponding to the first key. A second relay, which is in the same circuit as the first, is unaffected by the weak current.

If the second key is pressed instead of the first a current of an intensity 2 is sent through the relays which works the second one, and thereby calls into action a local current which traverses a second set of coils wound round the first relay, but in an opposite direction to the coil through which the line current passes, the consequence being that (as stated) the first relay is unaffected. This, however cannot be the case, as before the local current can be sent through the counteracting coils of the first relay, the tongue of the second relay has to pass from the back stop to the contact stop, and during this time the tongue of the first relay will be doing the same, especially as it is adjusted to work with a weak current and will consequently very quickly respond to the stronger current.

It is true that the moment the local current is called into action the tongue of the first relay falls back to its normal position, but in the mean time a signal has been made in the recording instrument which is not wanted, and which makes the system useless. No amount of adjustment in the relays will obviate this defect.

The following system is entirely free from this objection; and, moreover, is applicable to the apparatus in common use:—



2, 3, 1 at station A and 2_1, 3_1, 1_1 at station B are ordinary relays, so adjusted as to work with strengths of current equal to 2, 3, and 1 respectively.

At each station are two keys. One being an ordinary single current key 1 and the other also a single current key 1, but of that description used for offices where the battery is in a damp situation, and which is provided with a contact spring (S) beneath the front of the lever of the key and which has a separate contact, but which is worked by the lever of the key itself.

It will be seen that when the keys are in their normal position the line is to earth through them as in the ordinary duplex arrangement, but when key 1 is pressed down the earth is taken off and the battery of power 3 is called into action, and if the key 2 be pressed down a current of an intensity 1 is sent out; and, lastly, when both keys are depressed a current of an intermediate intensity 2 is transmitted.

It is necessary, in order to effect this, that a resistance be placed in the circuit of the smaller battery, otherwise the current instead of being reduced to 2 will be less than 1.

Suppose, now, key 1 at station A is pressed down, a current of a strength 1 traverses the 3 relays at the station B, and works relay 1_1, causing the recording instrument 1_1, in connection with it, to work. Next suppose, instead of key 1, key 2 be depressed, sending out a current of strength 3; this moves all three relays, but as the current to work the recording instrument 1_1 has to traverse either the tongue of relay 3_1 or 2_1 to work it, it cannot do so in this case, as both tongues will have left these stops before the tongue of relay 1_1 will have moved over to its contact stop, but relay 2_1 will work its recording instrument 2_1.

If now key 2 is pressed, the current sinks down to strength 2, and the tongue of relay 3_1 falls back and completes the circuit for the instrument 1_1, which, consequently, now works also. If now key 1 is raised, the strength of the current increases to 3, so that the tongue of relay 3_1 moves away from its stop and opens the circuit of instrument 1_1. Again, if instead of key 1, key 2 be raised, the current sinks to 1, and the tongue of relay 2_1 falls back, leaving only the tongue of relay 1_1 over which leaves instrument 1_1 only working.

Lastly, if both keys are raised, the three tongues will be in their normal position, and, consequently, the recording instruments also.

The spare stops to relays 3, 3_1 can be used to shunt off part of the current from relays 1, 1_1 when the currents of strength 3 are passing, so that they would respond more quickly when the current ceases.

It is unnecessary to trace out the courses of the currents when the two systems are duplexed, as there are no peculiarities involved.

Owing to the difficulty of obtaining the necessary instruments, I have not been able to give the system a practical test, but the theory being apparently perfect, it may possibly be worth a trial.

ATMOSPHERIC ELECTRICITY AND OZONE.

We make the following extracts from an exceedingly interesting paper, by George M. Beard, M.D., which was read before the "American Public Health Association," in New York, Nov. 13, 1873, and has recently been published in pamphlet form:

How the subject of Atmospheric Electricity and Ozone has been Investigated. — During the past quarter of a century regular daily observations of atmospheric electricity have been made in Brussels, Munich, and for the past ten or fifteen years in St. Louis. The difficulties in the study of the subject are very great, but, from the accumulated observations of the different investigators, some few interesting and important general facts have been secured.

Ozone-History.—From the earliest recorded ages a peculiar odour has been observed during thunderstorms and other electrical disturbances, and especially in connection with flashes of lightning. The

peculiar odour of thunder-bolts has been referred to by Homer, both in the "Iliad" and the "Odyssey." Jupiter is said to strike a ship with a thunder-bolt, "ἐν δὲ θεῖον πλῆτω," full of sulphurous odour, and to hurl a bolt into the ground "with the flame of burning sulphur." This peculiar sulphurous odour has been observed not only during thunder-storms, but also, it is said, during displays of northern and southern auroræ.

So long ago as 1785, Van Maurum, of Holland, observed that electric sparks passed through oxygen gas (that had been discovered by Priestley only eleven years before) gave rise to peculiar sulphurous or electrical odour; and, at the beginning of the present century, Cavallo, a prominent name in the history of electricity, called attention to the fact that this "electrified air," as it was termed, had an antiseptic effect on decomposing matter, and was a salutary application for fetid ulcers. In 1826 Dr. John Davy, in a measure anticipating Schönbein, recognized this pecularity of the atmosphere, and devised tests for detecting it.

The real scientific history of ozone dates from 1839, when Prof. Schönbein, of Basle, the renowned inventor of gun-cotton, observed that the electrolytic decomposition of water was attended by a peculiar odour resembling that evolved during the working of a frictional electric machine. In 1840 Schönbein called the attention of the scientific world to the newly discovered substance, to which he gave the name of *ozone*, from the Greek ὀζειν, to emit an odour. He showed that this odour appeared at the positive pole during the electrolysis of water. He furthermore pointed out that ozone may be produced by the slow oxidation of phosphorous in moist air or oxygen, and that the odour was similar to that which is observed during flashes of lightning. Schönbein studied hard on the subject for many years, and arrived at the conclusion that oxygen is capable of division into a negatively polar state, ozone, and a positively polar state, which he called *antozone*. During the past quarter of a century the subject of ozone has been studied by some of the most eminent scientists of the age, among whom we may mention the names of Berzelius, De la Rive, Marignac, Becquerel, Faraday, Fremy, Meissner, Houzeau, Scoutteten, Odling, Andrews, Tait, Fox, Fischer, Boeckel, Zeuger, Moffatt, Nasse, Engler, Erdmann, Angus Smith, Poey, A. Mitchell, Soret, Baumert, Williamson, and very many others.

Preparation of Ozone.—Ozone is prepared in various ways—by passing electric sparks, or electricity without sparks, through oxygen or air, by the electrolysis of acidulated water, by oxidizing phosphorus in moist air, by the action of strong sulphuric acid (three parts) on permanganate of potash (two parts), by sending water in the form of spray through air, by introducing hot glass rods into vessels filled with the vapour of ether, and by the slow oxidation of ethers and oils, &c., when exposed to light.

Properties of Ozone.—Ozone is a colourless gas, with a powerful and peculiar odour. Like oxygen, it is an oxidising agent of great power. It changes the black sulphate of lead into the white sulphate of lead. It oxidises antimony, manganese, arsenic, iron, zinc, tin, silver, lead, bismuth and mercury. Many of the lower oxides it transforms into peroxides. It corrodes india-rubber and decolorizes blue litmus-paper. It acts with great rapidity on iodide of potassium, liberating the iodine. It decomposes hydrochloric acid, liberating the chlorine. It is insoluble in acid, alkalies, alcohol, ether, the essential oils, and water. The odour of ozone is very penetrating; air containing but one-millionth of it is said to be perceptible to the smell. The peculiar odour of sea air is in part the result of ozone. All air, even the purest, has more or less ozone; but so accustomed do we become to it that it is only by sudden change into it that we perceive it. Visitors at the Mammoth Cave, Kentucky, report that, on emerging, the air has a peculiar and vivid odour, such as they never before realised. That we can in a half hour become so used to the foul air of a closed room that we do not perceive its odour until we leave it for a few moments and then return to it, is the experience of every one. The peculiar odour of ozone can be obtained very easily indeed by touching a metallic electrode of a galvanic battery of a number of cells against one of the plates of the batteries so as to make a connection of the current, or by touching the metallic ends of the poles for a moment with the spark thus produced.

Ozone in the Atmosphere.—Ozone, like electricity, exists normally in the atmosphere, but varies in amount in different localities at different seasons and in different hours of the day, and is considerably dependent on various meteorological conditions.

Average Quantity of Ozone in the Atmosphere.—The quantity of ozone in the atmosphere is exceedingly minute. The proportion varies with the locality, the season, the hour, etc., as we have already seen, and it also varies with the altitude, for it is with this agent as with electricity—it increases as we rise above the earth. According to Houzeau, air of the country, about six feet above the earth, contains about $\frac{1}{150000}$ of its weight of ozone, or $\frac{1}{700000}$ of its volume. The quantity is so minute that it may probably be increased tenfold without perceptible injury to man or animal.

Origin of Atmospheric Electricity and Ozone.—The sources of ozone in the atmosphere are almost innumerable. Like atmospheric electricity, it results from a wide variety of countless and ever-changing influences; it is one of the grand resultants of the ceaseless chemistry of the earth and sky. The evidence is now pretty clear that one prominent source of atmospheric ozone is in vegetable life. The oxygen that plants evolve from their leaves is more or less ozonized. It is claimed that ozone is developed with the perfume of flowers. The most odorous flowers, as the heliotrope, hyacinth, and mignonette, are the most prolific generators of ozone. The ozonic property of flowers is most manifest under the direct influence of sunlight. Lavender, fennel, mint, clove, and cherry-laurel evolve ozone with special abundance when exposed to the solar rays. It is believed that the oxidation of essential oils, as aniseed, bergamot, etc., under exposure to the light and air, develops ozone, and that in all flowers the source of the ozone is the essence; hence it is that the most odorous are the most ozoniferous.

We are then to look for the sources of ozone, as of electricity, in all the infinite play of terrestrial powers: in the falling away of the rocks and the

springing forth of plants; in the oxidation of metals and the emission of the perfume of flowers; in the deposition of dew, in the falling rain, the rattling hail, and the drifting snow; in the rushing of the wind and the conflict of the storm; in the friction of the clouds as they pass in the sky, or rest on the summits of the mountains; in the ceaseless evaporation on sea and on land; in the rushing torrents of the hills and the dashing breakers on the shore.

Physiological Effects of Ozone.—The physiological effects of ozone have been studied both on man and on animals. It is believed that the bracing and inspiring effect of a clear, crisp and sparkling morning is due in part to the great amount of ozone in the atmosphere. When it is held in combination with oxygen, or common air, it acts much like oxygen, but more powerfully. It affects the pulse, the respiration, and circulation in various ways, according to the quantity taken and the temperament of the individual. In this respect it behaves like electricity. It has been thought that ozone is formed in the body from the contact of oxygen gas with the blood, and there are those who believe that it is absorbed with the ozone in the air and is carried into the blood, where it takes part in the process of oxidation.

A TELEGRAPH POLE OF WROUGHT IRON.

THERE is now being built at the machine shop of Messrs. Townsend, Jackson & Co., in this city, an iron telegraph pole, ordered by the Western Union Telegraph Company, which is to be placed on the corner of Broadway and Twenty-third street, one of the most prominent points of observation in the City of New York. It is the invention of an Albanian, and of entirely novel construction compared with the method of making iron poles heretofore. It is the first practical invention that has ever brought such an article down to a cost sufficiently low as to compete with the use of wood, and it is claimed by the inventor that this can be done, under his patent, not only in the case of the large and costly poles used in cities, but even in the small and cheap ones used along the railroads and highways of the country.

When completed, it is lighter than a wooden pole of the same height, far stronger, and capable of supporting a much greater weight. Being of iron, it is of course more durable, and with proper care will outlast ten wooden poles. It is constructed of a number of wrought iron bars, rolled out the entire length of the pole, which bars are placed around light cast iron cores, arranged at proper intervals from each other. The cores have seats or notches to hold the bars in their places to prevent their moving sideways, and the bars also have notches into which the cores fit to keep them from moving up or down. Around the outside, where each core is placed, a ring or band of wrought iron is tightly fitted, which holds the bars firmly in their places, and thus forms the whole into a light, open and graceful column. Any number or any size of bars may be used, but it is found that six very light bars of angle iron arranged in this way afford a strength that fully meets that required for a telegraph pole of fifty feet in height. The cores are large at the base and are made smaller as they approach the top, which gives the column a graceful taper, and the whole is surmounted by a suitable cross head to hold the arms for the wires. Such a column is very simply constructed and is without a rivet throughout its entire length. No machinery or shop labour is required to put it together other than the making of the outside rings or bands by an ordinary blacksmith, so that the pole may be ordered in pieces and put together at the point where it is to stand. The column is suitable not only for telegraph poles but for masts for iron ships, derrick masts and booms, stringers for bridges, lamp posts, and a variety of other purposes.

We understand it is the intention of the Western Union Telegraph Company to introduce these poles in New York and other large cities, and we feel assured it is a move in the right direction. Iron poles have long been in use in all the cities of Europe, and this Company does not intend to allow the enterprise of our American telegraphic genius to be outrivalled or surpassed by that of any other nation. Independent of the symmetrical beauty of each pole made of this pattern, the very fact of uniformity in the construction and appearance of all the telegraph poles in a city, will take away much of the unsightliness at present complained of in regard to the wooden ones, and we are not sure but they will be more ornamental than otherwise in the streets. It is an easy matter to attach a street lamp to each pole, and thus make it serve a double purpose. It is considered by the most experienced telegraph men to be impracticable to lay the wires underground in the side streets of New York, and as soon as a scheme of rapid transit is decided upon, a suitable provision will doubtless be made in connection with it to accommodate all the wires in the city that run north and south. In the meantime iron poles are unquestionably better than wooden ones, and the use of iron lamp-posts in cities for so many years past, has proved that all things of a similar nature, that stand in the streets exposed to the public gaze, should be durable, ornamental and uniform.—*Albany Eve. Journal.*

ON THE ACTIONS PRODUCED BY THE SIMULTANEOUS MEETING OF BATTERY AND OF ELECTRO-CAPILLARY CURRENTS.

By M. BECQUEREL.

M. BECQUEREL inquiring if it were possible to increase or diminish the intensity of electro-capillary actions by making use of the current of a battery of several elements, used two apparatus. The first was a cracked tube containing a metallic solution, and immersed into an improuvette with an alkaline solution; the second was a pervious partition apparatus—a tube closed at bottom by a piece of parchment paper and containing a metallic solution. This latter was plunged into an eprouvette containing an alkaline solution. The electro-capillary action was increased by means of two plates of platinum in connection with a battery; the positive plate being immersed into the metallic solution and the negative plate into the alkaline. The resultant electro-chemical actions were very different according to the nature

of the solutions experimented upon. Copper and lead were reduced to the metallic state; silver, bismuth, and iron were hydrated with the alkaline; whilst gold and zinc gave no deposit. Wherefore these differences? They result undoubtedly from two existing currents, the lateral and central. The former tends to conduct metals in the metallic state to the negative surface of the pervious tissue, viz., the parchment paper, and at the same time the alkaline and the oxygen are transported to the positive plate. The elements meet on the negative surface, and the effects produced depend upon the affinities of these different substances; thus, if sulphur has a great affinity for the metal a sulphate will be produced. This takes place, as before stated, with silver, bismuth, and iron; but, if the reductive property of the current gets the better of the affinity of the metal for sulphur, a metallic reduction ensues, such as takes place with copper and lead.

STATISTICS OF IMPORTANT TELEGRAMS IN THE NETHERLANDS.

THE erroneous ideas which are formed on the subject of telegraphy cannot be more advantageously met than by the aid of statistics, which are collected from data, bearing on the subject of important telegrams in the Netherlands.

Although these data only bear on the work during a period of nine months, it was thought, at the time of the meeting of the Conference of St. Petersburg, to be inexpedient to delay the publication of the results arrived at.

Months.	Total Messages.	Important Messages.	Rate %
July, 1874	120,233	1,726	14·4
August, ,,	118,229	1,749	14·8
September, ,,	117,018	1,497	18·8
October, ,,	117,071	1,536	13 1
November, ,,	111,031	1,181	10 6
December, ,,	105,958	1,120	10·7
January, 1875	105,118	1,779	16·9
February, ,,	97,654	1,600	16·4
March, ,,	113,831	1,601	14·0

This table shows that experience continues to be in favour of the system of important messages receiving priority of despatch, for the number of messages of great importance is not of a scope sufficiently great to impede the free circulation of the general traffic. Moreover, as has been already shown (see *Journal Telegraphique* of January 25, 1874, No. 25), the expense necessitated by the erection and working of additional wires, would be to a great extent covered by the receipts arriving from the extra charge borne by important messages.

An analysis of the 13,789 important telegrams given in the above table, is as follows:—

Navigation	550
Press	339
Stock Exchange	10,157
Commercial Transactions ..	2,306
Private and family matters ..	377
Total ..	13,789

Of the total of 13,789 important messages, 12,350 circulated between Amsterdam and Rotterdam, and 1,433 in other directions.—*Journal Telegraphique.*

Notes.

IT appears that the telegraph steamer *Faraday* was spoken on the 1st inst., in lat. 49 N., long. 43.30 W., by the steamer *Prussian*, of the Allan line, which has arrived home from Quebec. The *Faraday* had previously been engaged in laying the Direct United States Company's cable, and it was understood, on the faith of certain semi-official announcements, that her mission had been successfully completed, and that the line would shortly be opened for public traffic. We are informed, however, that, according to a report from the *Prussian*, the *Faraday* when spoken was not sailing homewards, but was engaged with the cable, which had been buoyed in two places. The report further states that there was a heavy swell at the time, that the *Faraday* was east of all ice, and that there were numerous bergs between her and the land. If the cable had a double flaw which it was necessary to repair, the delay in opening for traffic is sufficiently explained.

The estimated gross receipts of the Anglo-American Telegraph Company, at 2s. per word, average about £1,400 per day. The actual average in June, 1874, at 4s. per word, was £1,950. The receipts appear to be steadily increasing.

No further announcement has been received relative to the opening of the Direct United States Cable.

The S.S. *Caroline* has been chartered by the Post Office, and is now engaged in effecting the repairs to the Channel Islands and the Isle of Man cables, which have been interrupted for some time.

The Wheatstone Automatic is about to be adopted by the Atlantic and Pacific Telegraph Company of the United States. The Automatic continues to work with the greatest success on the French Government lines between Paris and Marseilles, where it carries an enormous amount of traffic.

The Society of Telegraph Engineers now muster 717 members of all classes, made up of—

Honorary Members	4
Foreign Members	116
Members	215
Associates	369
Students	13
Total	717

The Meyer quadruplex is working well on the Paris and Lyons line. Two instruments working from each station on the one line.

An interruption has occurred to the Scilly Isles Cable. The fault is supposed to be about 200 yards from the landing place in the Scilly Isles. During the interruption, messages are forwarded "*Via* Port Penzance."

The Submarine Company announce that all their cables are in good working order.

Professor Cornu, of the *Ecole Polytechnique*, Paris, has put into successful use a new instrument for measuring the velocity of light between two stations in which an electrical registering apparatus is used, giving, it is believed, more accurate measurements than the well-known toothed wheel arrangement of Fizian. Foucault fixed the velocity of light, by his instrument, at 185,157 miles per second; Professor Cornu, by his new instrument, fixes the velocity of light at 186,660 miles per second, or 1,503 miles faster per second than Foucault.

The communication between St. Thomas and St. Kitts has been re-established, and messages for the various West India Isles are received.

A contract for submerging a telegraph cable between Sydney (Australia) and New Zealand has been signed between the Telegraph Construction and Maintenance Company and the Eastern Extension Telegraph Company.

The number of messages passing over the Cuba Submarine Telegraph Company's lines during the month of June was 2,471, estimated to produce £2,500, against 1,874 messages, producing £2,000, in the corresponding month of last year.

The report of the Eastern Telegraph Company (Limited) shows that the revenue for the six months ended 31st March last amounted to £200,500, from which, after deducting £52,756 for ordinary expenses, £12,831 for special expenditure, and £1,111 for income-tax, there remains £133,300, which, with the balance of £1,007 brought forward, makes £134,358 net profits. The sum of £46,212 has been paid as an interim dividend, and after providing for interest on debentures, a final dividend is recommended of 2s. 6d. per share, making, with the previous distribution, 5 per cent. for the year, and leaving £35,933 to be carried to the reserve fund, increasing that fund to £150,521.

We have received the following letter from the Manager of the Direct Spanish Telegraph Company (Limited)—

"106, Cannon-street, London, July 1.

"Sir,—Several shareholders having inquired the cause of the present low quotation of this company's ordinary and preference shares, I am instructed by the board to state that they see no ground for such depreciation; on the contrary, they congratulate the shareholders on the satisfactory progress of the company's business. The accounts for the half-year ending 30th ultimo show profits sufficient to pay a dividend for the past half-year at the rate of 5 per cent. per annum on the ordinary shares, after providing all interest on preference shares up to that date. All quarterly balances up to 31st March last have been regularly received from the Spanish and French Governments. Both the company's cables continue in excellent working order. —I am, Sir, your obedient servant,

CHARLES GERHARDI, Manager.

We learn that Mr. Fuller, the Managing Director of the Brazilian Submarine Telegraph Company, and Manager and Director of the Black Sea Telegraph Company, was prevented from taking part in the conference by the sudden death of his relative, Admiral Sherard Osborne.

Two sets of Professor Wheatstone's Automatic Printing Instruments have been set up for traffic between Sydney and Melbourne.

The receipts of the Submarine Telegraph Company for the month of June amounted to £9,376 18s. 4d., against £9,186 19s. for the corresponding period of 1874.

ELECTRIC LATHE CHUCK.

IN order to obviate the inconvenience and loss of time involved in the ordinary mode of fixing upon a lathe chuck certain special kinds of work, such as thin steel disks or small circular saws, the chuck is converted into a temporary magnet, so that the thin steel articles, when simply placed on the face of the chuck, are held there by the attraction of the magnet; and, when finished, can be readily detached by merely breaking the electric contact and de-magnetizing the chuck. The face plate of the magnetic chuck is composed of a central core of soft iron, surrounded by an iron tube, the two being kept apart by an intermediate brass ring; and the tube and core are each surrounded by a coil of insulated copper wire, the ends of which are connected to two brass contact rings that encircle the case containing the entire electro-magnet thus formed. These rings are grooved, and receive the ends of a pair of metal springs connected with the terminal wires of an electric battery, whereby the chuck is converted into an electro-magnet capable of holding firmly on its face the article to be turned or ground. For holding articles of larger diameter, it is found more convenient to use an ordinary face plate, simply divided into halves by a thin brass strip across the centre; a horse shoe magnet, consisting of a bent bar of soft iron, with a coil of copper wire round each leg, is fixed behind the face plate, each half of which is thus converted into one

of the poles of the magnet. The whole is enclosed in a cylindrical brass casing, and two brass contact rings fixed round this casing are insulated by a ring of ebonite, and are connected with the two terminal wires of the magnet coils. A similar arrangement is also adapted for holding work upon the bed of a planing or drilling machine, in which case the brass contact rings are dispensed with, and any desired number of pairs of the electro-magnetic face plates are combined so as to form an extended surface large enough to carry large pieces of work. For exciting the electro-magnet, any ordinary battery that will produce a continuous current of electricity can be used; but in machine shops, where power can be obtained, it is more convenient to employ a magneto-electric machine—such as Gramme's, for instance—rather than a battery.—*Scientific American.*

RAILWAY COMPANIES *v.* GOVERNMENT TELEGRAPHS.

Our contemporaries have from time to time published alarming statements of the magnitude of the claims preferred by the railway companies for the purchase of their so-called interests in telegraph business, and have declared that the Government of 1868 was left in ignorance of those claims when the Telegraphs Act was passed. It has not signified to them that the Telegraphs Act of 1868 provided for the very claims of which its promoters were supposed to be ignorant.

It has frequently been pointed out on the part of the Government that the claims of the railway companies were not to be taken as a strict measure of the sum which the companies would receive. We believe that in every case in which the Government has come to an arrangement with a railway company, either voluntarily or by arbitration, the sum taken by the company has fallen far short of that which it desired to have. In saying this we are not blaming the directors of the railway companies. It was their business to get what they could for their shareholders.

The case of the Great Eastern Railway Company has recently been under arbitration, and the award of the umpire, Mr. Russell Gurney, shows in a striking manner how wild have been the notions put forth to the public of the sums which the railway companies were likely to get. The Great Eastern Railway Company, we believe, claimed upwards of half a million of money *in meal and malt*, and also tendered a bill of costs of upwards of £12,000. It is understood that Mr. Gurney has awarded them about £77,000 in lieu of the half million, and that out of their claim for costs he has only allowed against the Post-office the sum of £3,000.

We understand that the terms which the Great Eastern Company have obtained, after a protracted struggle, are pretty much the same with those which the Post Office accorded voluntarily six years ago to the largest railway company in the kingdom, and which, while they are fair to the Government, are not illiberal to the railway shareholders.

We hope that the shareholders in those companies whose cases are still under consideration will take a warning by this result, and put no faith in the extravagant expectations which have been held out to them.

TELEGRAPHY AT ALDERSHOT.

At the summer manœuvres on Tuesday, 13th July, 1875, a line of telegraphic communication was laid down with Aldershot, and was in good working order when the staff arrived, but unfortunately there was no one at the other end to receive any communications that were sent. Every year the Royal Engineers appear to improve in the rapidity and certainty with which they perform their duty. During all the sham fights which have taken place recently, a wire has been laid in rear of both flanks of the army, and a central office opened. The desire of many officers of experience has been that the army signallers should be so posted as to be in communication with either flank or the centre of a force; and that mounted orderlies should be in attendance at all the offices to convey at once messages to the staff. The idea is an admirable one, but has not yet been fully carried out. Generals also at present do not seem to realise the importance of telegraphic communication. For instance, last Saturday Sir John Douglas was warned over the wire that a large force was marching on his right. He relied on the cavalry for the information instead of the electric current, and the warning was received. The signallers who were out that day were charged with being incompetent, but now that a couple of days have elapsed since the action, it appears that these very intelligent men were not so much to blame as the 14th Hussars, whose advance was so tardy that the signallers never had an opportunity of getting into a position from which they could do their work, until the enemy drove them in. For them to have advanced beyond the cavalry on that occasion would only have been to ensure their capture by the attacking force. It is only just to the Royal Engineers to say that had Sir John Douglas relied upon the telegraph more than he did, he would probably have been in a much better position to resist the attack which was made upon him.

New Electro-magnetic Clock at the London Post-office.—Messrs. T. Cooke and Sons, of York, have just completed the erection of an electric motor and clock-dial in the telegraph gallery of the new buildings of the London General Post-office, St. Martin's-le-Grand, which, in some points, is novel and interesting. The hands of the large dial, which are driven by the motor, are at a distance of about forty-five feet from it, and are connected to it by means of iron rods and several pairs of bevel-wheels for turning the bends. The dial itself is six feet in diameter, and such is the sensitiveness and power of the motor that the connecting rods, bevel-wheel work, and hands, are driven by a single Leclanché cell, the current from which is transmitted to the motor every second by the standard clock in the gallery. The motor consists simply of what we may term a polarised pendulum vibrating between two pairs of electro-magnets, and carrying a double ratchet at the upper end. The same firm have erected a corresponding dial at the opposite end of the gallery for showing the direction of the wind, the pointer of which is worked by a vane at the top of the buildings.

To Correspondents.

*** Duly authenticated contributions, theoretical and practical, on every subject identified with the interests of which "The Telegraphic Journal" is the organ, will always command attention. Anonymous correspondence will be wholly disregarded. Literary communications and books for review should be addressed to the Editor; business communications to the Publishers, 10, Paternoster Row, E.C.